orthodox systems. They have no word for orthodox; nay, we saw that some of these systems, though atheistic, were nevertheless treated as permissible doctrines, because they acknowledged the authority of the Veda. Orthodox might therefore be replaced by Vedic; and if atheism seems to us incompatible with Vedism or Vedic orthodoxy, we must remember that atheism with Indian philosophers means something very different from what it means with us. It means a denial of an active, busy, personal or humanised god only, who is called Isvara, the Lord. But behind him and above him Hindu philosophers recognised a Higher Power, whether they called it Brahman, or Paramatman, or Purusha. It was the denial of that reality which constituted a Nastika, a real heretic, one who could say of this invisible, yet omnipresent Being, Na asti, 'He is not.' Buddha therefore, as well as Brihaspati, the Charvaka, was a Nastika, while both the Yoga and the Samkhya, the former Sesvara, with an Isvara, the other Anisvara, without an Isvara, the one theistic, the other atheistic, could be recognised as orthodox or Vedic."

The most prominent representative of heretics is Buddha and, although Prof. Max Müller is decidedly an adherent of Brahman Philosophy in contrast to Buddhism, which denies the existence of the atman, the favorite idea of Brahmanism, he speaks very highly of Buddha, saying:

"Out of the midst of this whirlpool of philosophical opinions there rises the form of Buddha, calling for a hearing, at first, not as the herald of any brand-new philosophy, which he has to teach, but rather as preaching a new gospel to the poor. I cannot help thinking that it was Buddha's marked personality, far more than his doctrine, that gave him the great influence on his contemporaries and on so many generations after his death.

"Whether he existed or not, such as he is described to us in the Suttas, there must have been some one, not a mere name, but a real power in the history of India, a man who made a new epoch in the growth of Indian philosophy, and still more of Indian religion and ethics."

There is no need of recommending the book to the reader. The passages quoted speak for themselves. Even where we cannot follow Prof. Max Müller in his arguments or take issue with his propositions, we admire the penetration of his thoughts and the brilliancy of his style.

P. C.

HENRI POINCARÉ, WISSENSCHAFT UND HYPOTHESE. Autorisierte deutsche Ausgabe mit erläuternden Anmerkungen. Von *F.* und *L. Lindemann*. Leipsic: B. G. Teubner. 1904.

Professor Ferdinand Lindemann, one of the leading mathematicians of Germany, has undertaken the laudable task of translating a series of essays written by his French colleague, Prof. Henri Poincaré, and Mrs. Lindemann,

the translator's wife, has done so much of the literary labor of the work that her name also appears on the title-page.

Poincaré's position in the philosophy of mathematics is in its main outlines well known to mathematicians and perhaps also to those of our readers who have studied the essays which he contributed to *The Monist,* but we offer here a résumé in quotations, methodically compiled by Professor Lindemann, which covers almost the entire field and affords a bird's-eye view of Professor Poincaré's position as regards the foundation of geometry and arithmetic and the definition of mechanics. Professor Lindemann selects the following passages from Poincaré as specially characteristic:[1]

"Our understanding has a direct conception of the power of mind (which implies the conviction that an infinite repetition of the same procedure can be imagined), and experience can be only an opportunity to make use of it and to become conscious of it." (Page 13.)

This is good Kantian doctrine according to which experience is not the main source of our knowledge. But let us proceed in our quotations:

"The geometrical axioms are neither synthetic judgments *a priori* nor experimental facts. They are determinations based upon general consent, which is to say, they are concealed definitions. Geometry is not a science of experience, though experience guides us in the proposition of axioms. Experience does not decide which geometry is the right one but which is the most convenient one. It is just as irrational to investigate whether the fundamental principles of geometry are true or false as it would be to ask whether the metric systems be wrong or false." (Pages 51, 73, and 138.)

Next in order are three quotations on physics and mechanics:

"The law of gravitation which in some special cases has been proved by experience can be boldly universalised, because we know that in all cases experience can neither prove nor disprove it." (Page 99.)

"The principle of action and reaction being equal cannot be regarded as an experimental law but only as a definition." (Page 102.)

"Experience can serve as a basis for the principles of mechanics but it can never contradict them." (Page 107.)

"The principles of mechanics are based on consent and are concealed definitions. They are derived from experimental laws. These laws are, as it were, presented as principles, for our understanding attributes to them absolute validity." (Page 140.)

Without taking exception to Poincaré's statements as to the validity of a universalisation of gravitation, we wonder at the argument which he adduces in its favor. That experience can neither prove nor disprove a generalisation, is no sufficient reason to make us bold. Further, that experience can never

[1] The pages in parentheses refer to Professor Lindemann's translation.

contradict the principles of mechanics is exactly the crux of the main problem. Finally, we must express our doubt as to the propriety of two terms, viz., "consent" and "definition." Both are employed by Poincaré and occur in the last quoted passage. It is not a mere "consent" if the physicist claims an absolute validity for his principles of mechanics, and mathematical axioms are more than "definitions"; they are definitions, the formulation of which is inevitably forced upon the mathematician. Their inevitableness is their most significant feature.

After this digression we revert to Poincaré:

"If one wants to regard the principle of the conservation of energy in its sweeping universality and apply it to the universe, one sees it as it were volatilised and nothing remains except the sentence: 'There is a something that remains constant.'" (Page 134.)

"Experiment is the sole source of truth." (Page 142.)

This statement must be understood so as not to contradict previous propositions savoring of Kantian apriorism. It means simply that experiment is the sole method of extending our knowledge of facts, for Poincaré adds that experiment must be improved. Something has to be added. He says:

"Mathematical physics has the duty to guide generalisation so as to increase the efficiency of science." (Page 144.)

"Each generalisation presupposses to a certain extent the faith in the unity and simplicity of nature." "But" adds he, "it is not sure that nature is simple." (Page 152.)

We conclude this summary of Poincaré's views with three more passages:

"The purpose of mathematical science is not to explain the true nature of things. Her sole aim is to interconnect physical laws with which experience makes us acquainted, but which cannot be expressed without the assistance of mathematics." (Page 212.)

"We care little whether ether really exists. It is essential, however, that everything happens as if it existed and that this hypothesis is convenient for an explanation of phenomena." (Page 212.)

"The goal which it is possible for science to attain is a cognition of things in their interrelations. Outside of these relations there is no cognisable reality." (Page xiii.)

Professor Lindemann adds in characterisation of Poincaré's standpoint:

"The reader will notice that we have thus returned to Kant's proposition, according to which the understanding does not derive laws from nature but prescribes them to nature and that the highest legislator of nature lies in ourselves, i. e., in our understanding or, as Goethe expresses it: 'Everything transient is but a simile,'—a simile which refers to the same thought if one is conscious of the relativity of all knowledge. All such universal propositions

are possessed of a high subjective significance, for they satisfy in a certain sense our need of a completion of inquiry and cognition. For the empirical inquirer, however, there is no such completion. Every general proposition needs according to him a continued investigation under the guidance of experience, and to him it is valid only so long as he finds himself in agreement with experience, whether we have to deal with a universal necessity of our mind or with a special doctrine of the exact sciences." * * * "Even those who do share the purely empirical standpoint" adds Professor Lindemann, "will feel the need of pursuing the leading principles throughout all the intricate paths of the exact sciences, and they will gladly accept the guidance of the author (Poincaré) in order to temporarily remove the exuberant vines of detail and to gain an outlook upon the interstices between the firm tree trunks of experience for the sake of orientation. The apparent ease with which our author attains his aim is the main cause that will prove attractive; it did so at least with me.

"We must not lay main stress upon the results gained in the present work but upon the method of treatment, and the method which has been pursued by M. Poincaré is the one which during the last decades has led to satisfactory results in the field of the foundations of geometry and arithmetic. It consists in replacing an hypothesis, admissible according to our experience, when its relation to other theories is to be investigated, by an assumption which would satisfy our logical thought without agreeing with experience. In this way we are enabled to make the mutual dependence of the different hypotheses or axioms conceptually evident."

Professor Lindemann has not only selected essays which allow us to understand Poincaré's thought as a systematic whole, but has also added to them explanations and notes and in addition furnished literary references for a further study of the several questions.

Considering the difficulties of the translation in which Mrs. Lindemann has been a faithful helpmeet to her husband, we must acknowledge that the work could scarcely be surpassed. The work reads as if it had originally been written in German. The subject-matter of the work is discussed in four parts: I., number and magnitude; II., space; III., "Kraft" (i. e., force or energy); IV., nature.

The first part contains articles on the nature of mathematical and syllogistic deduction, verification and proof, the elements of arithmetic, algebraic methods, recurrence, induction, mathematical construction, mathematical magnitude and experience, the incommensurable, the physical, and the mathematical continuum, measurable magnitude, the physical and the mathematical continuum of many dimensions.

The second part discusses such subjects as the several non-Euclidean

geometries, those of Lobatchevski and of Riemann, that of curved space, and the fourth geometry, so called, and Lie's proposition. Further, geometrical space and space conception, the space of vision, the space of touch, and of motion, change of place, solid objects and geometry, the laws of homogeneity, the non-Euclidean world, the four-dimensional world, geometry and astronomy, law and relativity, the applicability of experiment, and a ventilation of the question, "What is a point?"

Among the articles treated in the third part are the following: the principle of inertia, the law of acceleration, anthropomorphic mechanics, the school of the thread (referring to Andrade's method which implies the use of a thread), relative and absolute motion, the methods of Newton, energy and thermo-dynamics.

The fourth part opens with a discussion of the significance of experiment and generalisation, the unity of nature, the use of hypothesis, the origin of mathematical physics, the theories of modern physics, physics and mechanicalism, the present state of science, the calculus of probabilities, *rouge et noir,* the probability of causes, the theory of mistakes, etc., optics and electricity, Fresnel's and Maxwell's theories, the mechanical explanation of physical phenomena, electro-dynamics, Ampère's and Helmholtz's theories and their difficulties, Maxwell's theories, Rowland's experiments, and Lorentz's theory.

The annotations by Professor Lindemann are a valuable addition comprising ninety pages, almost one-third of the whole volume.

The work is important for the student of mathematics and especially the philosophy of mathematics, for it summarises the life work of a prominent thinker along these lines.

GRUNDRISS DER RELIGIONSPHILOSOPHIE. Von *D. Dr. A. Dorner.* Leipsic: Dürr'schen Buchhandlung. 1903. Pp. xviii, 448.

One of the leading and most prominent theologians of Germany expounds in the present volume of over 400 pages the theological convictions that may be regarded typical of orthodox protestant theology modernised by philosophy and science. Our author recognises philosophy as an independent science, but assures himself of the ground which is taken by religious philosophy, and he comes to the conclusion that the object of faith presupposes something real and objective; it cannot be the product of mere subjective fancy, but all the data of our experiences point to it that we have to deal not with hallucinations but with experiences based on actual facts. The province of metaphysics according to Dorner is "to comprehend the being which constitutes the basis of existence of the world" and this being cannot be a simple substance, nor can it be a manifold, a combination of many realities of spiritual monads, but "it must be one substance conceived in such a way as to show that it is the